Acoustical Assessment Technical Report

Rail Tie Wind Project
Albany County, Wyoming

Prepared for:

ConnectGen Albany County LLC

April 2020

TETRA TECH

Business Confidential

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1 INTRODUCTION

At the request of ConnectGen Albany County LLC (ConnectGen), Tetra Tech, Inc. (Tetra Tech) has prepared this acoustical assessment for the Rail Tie Wind Project (Project). This document is intended to provide reviewing regulatory agencies with information on potential noise impacts resulting from development of the Project.

1.1 Project Background

The Project is located in southeastern Albany County, Wyoming, and encompasses approximately 26,000 acres of ranchland on private and state lands near Tie Siding, Wyoming (Project Area; Figure 1). The Project would include up to 149 wind turbine generators (WTGs), each ranging between 3.0 to 6.0 megawatts (MW) in size, with a combined maximum generating capacity rating of 504 MW. The Project proposes to interconnect to the existing transmission system of the Western Area Power Administration (WAPA) via the Ault-Craig 345-kilovolt (kV) transmission line, which runs through the Project Area.

For construction planning and site optimization, the Project consists of two separate phases, each approximately 252 MW. Construction of the Project is expected to begin in 2021, and both phases could be fully operational by the end of 2022. As is common with large wind projects, the Project may require two years to fully construct. If additional time is required to facilitate construction, it is anticipated that the first 252 MW phase would be completed and fully operational by the end of 2022, and the second phase operational in 2023.

1.2 Analysis Area

The analysis area for this acoustical assessment incorporates noise sensitive areas (NSAs; i.e., residences, businesses, etc.) within a 2-mile radius of the Project Area. As noted above, ConnectGen is currently considering a range of WTG models between 3.0 to 6.0 MW in size. In order to adequately and conservatively quantify the potential noise impacts of the Project, this analysis evaluates a noise scenario for the Project utilizing a representative layout that incorporates the maximum number (149) of WTGs (Figure 1) and utilizing the WTG model with the highest sound emission levels as well as the lowest proposed hub height within the 3.0 to 6.0 MW range of WTG models being considered by ConnectGen.

2 ACOUSTICAL CONCEPTS AND TERMINLOGY

This section outlines some of the relevant concepts in acoustics to help the non-specialist reader best understand the modeling assessment and results as presented in this report.

Airborne sound is described as a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Sound energy is characterized by the properties of sound waves, which include frequency, wave length, amplitude, and velocity. A sound source is defined by a sound power level (L_W), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts (W). Sound energy propagates through a medium where it is sensed and then interpreted by a receiver. A sound pressure level (L_P) is a measure of this fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. Sound power, however, cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source.

While the concept of sound is defined by the laws of physics, the term ‘noise’ has further qualities of being excessive or loud. The perception of sound as noise is influenced by several technical factors as loudness, sound quality, tonality, duration, and existing background levels. Sound levels are presented on a logarithmic scale to account for the large range of acoustic pressures that the human ear is exposed to and is expressed in units of decibels (dB). A decibel is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals. Conversely, sound power is referenced to 1 picowatt.

Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves and typically the frequency analysis examines nine octave bands from 32 Hz to 8,000 Hz. Since the human ear does not perceive individual frequencies with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter (ANSI S1.42-2001, ANSI 2016) is applied to compensate for the frequency response of the human auditory system and sound exposure in acoustic assessments is designated in A-weighted decibels (dBA). Unweighted sound levels are referred to as linear. Linear decibels (dBL) are used to determine a sound’s tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Typical sound pressure levels associated with various in-air activities and environments are presented in Table 1.

Table 1: Sound Pressure Levels of Typical In-Air Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Jet aircraft takeoff from carrier (50 feet)	140	Threshold of pain
50-horsepower siren (100 feet)	130	
Loud rock concert near stage Jet takeoff (200 feet)	120	Uncomfortably loud
Float plane takeoff (100 feet)	110	
Jet takeoff (2,000 feet)	100	Very loud
Heavy truck or motorcycle (25 feet)	90	
Garbage disposal Food blender (2 feet) Pneumatic drill (50 feet)	80	Loud

Table 1: Sound Pressure Levels of Typical In-Air Noise Sources and Acoustic Environments

<table>
<tr><th>Noise Source or Activity</th><th>Sound Level (dBA)</th><th>Subjective Impression</th></tr>
<tr><td>Vacuum cleaner (10 feet)</td><td>70</td><td rowspan="3">Moderate</td></tr>
<tr><td>Passenger car at 65 miles per hour (25 feet)</td><td>65</td></tr>
<tr><td>Large store air-conditioning unit (20 feet)</td><td>60</td></tr>
<tr><td>Light auto traffic (100 feet)</td><td>50</td><td rowspan="2">Quiet</td></tr>
<tr><td>Quiet rural residential area with no activity</td><td>45</td></tr>
<tr><td>Bedroom or quiet living room
Bird calls</td><td>40</td><td rowspan="2">Faint</td></tr>
<tr><td>Typical wilderness area</td><td>35</td></tr>
<tr><td>Quiet library, soft whisper (15 feet)</td><td>30</td><td>Very quiet</td></tr>
<tr><td>Wilderness with no wind or animal activity</td><td>25</td><td rowspan="2">Extremely quiet</td></tr>
<tr><td>High-quality recording studio</td><td>20</td></tr>
<tr><td>Acoustic test chamber</td><td>10</td><td>Just audible</td></tr>
<tr><td></td><td>0</td><td>Threshold of hearing</td></tr>
</table>

To take into account sound fluctuations, environmental noise is commonly described in terms of equivalent sound level (L_{eq}). The L_{eq} value is the energy-averaged sound level over a given measurement period. It is further defined as the steady, continuous sound level, over a specified time, which has the same acoustic energy as the actual varying sound levels. Levels of many sounds change from moment to moment. Some sharp impulses last 1 second or less, while others rise and fall over much longer periods of time. There are various measures of sound pressure designed for different purposes. Statistical sound levels (L_n) provide the sound level exceeded for that percentage of time over the given measurement period. An L_{10} level is often referred to as the intrusive noise level and is the sound level that is exceeded for 10 percent of the time during a specified measurement period. L_{50} is the level exceed 50 percent of the time and is typically referred to the median sound level over a given period. The L^{90} percentile metric is often referred to as the residual sound level, representing the quietest 10 percent of any time period.

3 REGULATORY FRAMEWORK

3.1 Federal Regulations

3.1.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires the disclosure of potential environmental impacts for projects with a federal action, through either a Categorical Exclusion, Environmental Assessment, or Environmental Impact Statement (EIS), as well as a process of public and agency review and comment.

WAPA's action on the interconnection request is considered a major federal action subject to NEPA, in accordance with Council on Environmental Quality (CEQ) regulations for implementing NEPA, and DOE NEPA Implementing Procedures (40 CFR Parts 1500−1508, 10 CFR Part 1021).

This technical report provides information to assist WAPA in analysis of the potential effects to the natural and human environments associated with approving or denying the interconnection request.

3.2 State Regulations

3.2.1 Wyoming Industrial Development Information and Siting Act

The Wyoming Department of Environmental Quality (WYDEQ) Industrial Siting Division (ISD) administers the Wyoming Industrial Development Information and Siting Act (Act; Wyoming Statute § 35-12-101:119) and the Rules and Regulations of the Industrial Siting Council (ISC), Chapters 1 and 2. The Act is designed to protect Wyoming's environmental, social, and economic fabric of communities from unregulated large-scale industrial development. By consolidating the review of 19 independent state agencies into one comprehensive permitting process, the Act offers a thorough analysis of the development's impacts to the public and affected agencies.

Pursuant to the Act, all wind energy projects consisting of 30 or more turbines (in all planned phases of the installation) and/or exceeding the statutory threshold construction cost amount of $222.8 million are subject to review and approval by the ISC. For facilities permitted under Wyoming Statute (WS) § 35-12–102(a)(vii)(E) and (F), a site reclamation and decommissioning plan and a financial assurance plan are required pursuant to WS § 35-12-105(d) and (e).

As part of the review and approval process, the ISC requires submittal of an application that outlines the evaluation of potential project impacts and mitigation measures related to environmental, social and economic resources.

3.3 Local Regulations

3.3.1 Wind Energy Conversion System Permit

The Albany County Wind Energy Siting Regulations require that all facilities with an aggregate generating capacity greater than 25 kilowatts apply for a Wind Energy Conversion System (WECS) Use Permit (Albany County 2017). The application process involves the review and recommendation of the Planning and Zoning Commission and the approval of the Board of County Commissioners as well as community input during a defined and requisite public hearing and comment period (§§18-5-502(a)). The WECS permit applicants must certify that the Project would comply with all applicable state and county zoning and land use regulations. As part of the application, potential impacts to resources such as economic, air quality, water quality, general nuisances, soil disturbance, wildlife, and cultural resources must be addressed.

Specifically, as part of the permit conditions, the Albany County Wind Energy Siting Regulations limit noise from commercial wind energy facilities to 55 A-weighted decibels (dBA) as measured at a point along the common property lines between a non-participating property and a participating property. This limit includes the following conditions:

a. *This level may be exceeded during short-term events such as utility outages, severe weather events, and construction or maintenance operations.*
b. *This standard shall not apply along any portion of the common property line where the participating property abuts state or federal property.*
c. *Noise levels may exceed fifty-five (55) dBA limit along common property lines if written permission, as recorded with the Albany County Clerk, is granted by the affected adjacent non-participating property owners.*

4 METHODOLOGY

Sound generated by an operating WTG is comprised of both aerodynamic and mechanical sound with the dominant sound component from modern utility scale WTGs being aerodynamic. Aerodynamic noise results from air flowing across and around each blade of the turbine. Secondarily, mechanical sound is generated by machinery located inside the nacelle of the turbine, such as gearboxes, motors, cooling systems, and pumps. Due to the improved design of WTG mechanical components and the use of improved noise damping materials within the nacelle, including elastomeric elements supporting the generator and gearbox, mechanical noise emissions have been minimized by manufacturers.

Wind energy facilities, in comparison to other energy-related facilities, are somewhat unique in that the sound generated by each individual WTG will increase as the wind speed increases. The sound emitted by a WTG is strongly dependent on the speed of the tip of the blade, the design of the blade, and on atmospheric conditions such as the degree of turbulence. Blade noise increases with increasing wind speed until full rated electrical power is achieved due to the interaction between the incident turbulence eddies and the blade surface. The prevalence of this inflow turbulence noise will vary depending on site-specific and variable atmospheric conditions. The second mechanism is the shedding of vortices that form at the tip of each blade. This depends on the strength of the vortex and the design of the blade tip. Finally, noise may be generated by turbulent flow over the trailing edge of the blade. As air flows over the face of the blade, a turbulent boundary layer develops, but remains attached to the trailing edge. Eddies extending past the trailing edge cause sound emission scattering, resulting in the characteristic WTG broadband swooshing sound. This turbulent boundary layer noise (trailing edge noise) usually defines the upper limit of WTG noise levels and is considered the greatest contributor to aerodynamic noise.

It is important to recognize that as wind speeds increase, the background ambient sound level will generally increase as well, resulting in acoustic masking effects; however, this trend is also affected by local contributing sound sources. The net result is that during periods of elevated wind speeds when higher WTG sound emissions occur, the sound produced from a WTG operating at maximum rotational speed may be largely or fully masked due to wind-generated sound in foliage or vegetation. In practical terms, this means a nearby noise sensitive area (NSA) would tend to hear leaves or vegetation rustling rather than WTG noise. This relationship is expected to further minimize the potential for any adverse noise effects of the Project. Conversely, these acoustic masking effects may be limited during periods of unusually high wind shear or at NSA's that are sheltered from the prevailing wind direction.

4.1 Acoustic Modeling Software and Calculation Methods

To assess the noise emissions of a wind energy facility prior to construction, it is necessary to have prediction models with which a noise emission source level measured at a given reference point can be certified. A generally accepted approach for modeling a wind turbine as an idealized point source is described in International Organization for Standardization (ISO) 9613-2, "Attenuation of Sound during Propagation Outdoors" (ISO 1996). The standard specifies methods to enable noise levels in the community to be predicted from sources of known sound emission and provides a summary of existing knowledge on outdoor sound propagation as published by ISO, a worldwide federation of national standards bodies. The calculation methodologies described are relied on by professionals in the field of acoustics.

Standard acoustic engineering methods that conform to ISO 9613-2 were used in this noise analysis using DataKustik GmbH's CadnaA, the computer-aided noise abatement program (version 2019 MR1; DataKustik GmbH 2019). The engineering methods specified in this standard consist of full (1/1) octave band algorithms that incorporate geometric spreading due to wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of both sources and noise sensitive areas, seasonal foliage effects, and meteorological conditions. Operational broadband sound pressure levels were calculated assuming that all WTGs are operating continuously and concurrently at the maximum manufacturer-rated sound level. The sound energy was then summed to determine the equivalent continuous A-weighted downwind sound pressure level at a given point of reception.

The effects of topography were incorporated into the noise prediction model using ground contour data from the official U.S. Geological Survey (USGS) digital elevation model to accurately represent terrain in three dimensions. Terrain conditions, vegetation type, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613-2 standard accounts for ground absorption rates by assigning a numerical coefficient of G=0 for acoustically hard, reflective surfaces and G=1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, bare rock, or sound traveling over water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in vegetation, including suburban lawns, livestock, and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation (i.e., G=1.0). For the purposes of this modeling analysis, a semi-reflective ground absorption factor (G=0.5) was applied throughout the Project Area. In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. To be conservative, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was not included in the model. Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, a temperature of 10°C (50°F) and 70 percent relative humidity parameters were selected as reasonably representative of conditions favorable to sound propagation.

Since it is not possible to account for all factors that affect sound propagation and attenuation, acoustic modeling followed the methodologies as described in the ISO 9613-2 standard, which have been accepted as reasonably conservative, to support noise prediction for the Project. Inherent to the ISO 9613-2 standard is the assumption of downwind sound propagation conditions. That is, the WTG sound power levels and modeling methods are representative of when the wind is blowing from the WTG to the NSA. In fact, the ISO 9613-2 modeling method unrealistically assumes that downwind conditions exist in all directions, between each WTG and each NSA simultaneously, even though this is physically impossible. Therefore, lower levels are expected in the upwind direction. In addition, the acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix. This conservative assumption does not take into consideration turbulent eddies and micrometeorological variations that may form when winds change speed or direction, which can interfere with the sound wave propagation path and increase attenuation effects.

4.2 Wind Turbine Acoustic Modeling Input Parameters

As noted above, in order to adequately and conservatively quantify the potential noise impacts of the Project, a noise scenario assessment was performed utilizing a representative layout that incorporated the maximum number (149) of WTGs and the WTG model with the highest sound emission levels as well as the lowest proposed hub height within the 3.0 to 6.0 MW range of WTG models being considered by ConnectGen.

Based on this approach, the following wind turbine model was selected for evaluation in this analysis:

- General Electric Company (GE) 3.0-127—WTG with a rotor diameter of 127 meters (m) and a hub height of 89 m.

To assist project developers and acoustical engineers, wind turbine manufacturers report wind turbine sound power data at integer wind speeds referenced to the effective hub height, ranging from cut-in to full rated power. This accepted International Electrotechnical Commission (IEC) standard was developed to ensure consistent and comparable sound emission data of utility-scale WTGs between manufacturers (IEC 2012). The IEC test is an accepted standard providing a uniform methodology for measuring the noise emissions of a WTG from cut-in through full rotational wind speeds. The IEC testing standard defines deviation values σ_T, σ_R and σ_P for measured apparent sound power levels as described by IEC/Technical Standard 61400-14, where σ_T is the total standard deviation, σ_R is the standard deviation for test reproducibility, and σ_P is the standard deviation for product variation (IEC/TS 2005). To account for this inherent deviation associated with the IEC testing methodology, a confidence interval of k = 2 dBA was applied. The combination of the modeling parameters used and the inclusion of the 2-dBA confidence interval are expected to result in a reasonable and conservative assessment of Project sound levels since it is unlikely that all WTGs would be operating concurrently at 2 dB above the mean.

Table 2 summarizes the sound power data correlated by wind speed at reference rotor hub height. It is assumed that the WTG models selected for the Project will have similar sound power profiles to those used in the acoustic modeling analysis; however, it is possible that the final manufacturer warranty values may vary slightly. A summary of sound power data for the GE 3.0-127 WTG by octave band center frequency during maximum rotational speed is presented in Table 3.

Table 2: GE 3.0-127 Wind Turbine Broadband Sound Power Levels Correlated with Wind Speed with a Hub Height of 89 meters

Hub Height Wind Speed (m/s)	6	7	8	9	10	11	12
Sound Power Level (dBA)	100.4	103.9	106.8	109.2	110.0	110.0	110.0

Source: GE Renewable Energy 2018.

Wind turbines can be somewhat directional, radiating more sound in some directions than others. The IEC test measurement protocol requires that sound measurements are made for the maximum downwind directional location when reporting apparent sound power levels. Thus, it is assumed that WTG directivity and sound generating efficiencies are inherently incorporated in the sound source data and used in acoustic model development. A summary of sound power data by octave band center frequency for the WTGs operating at maximum rotational speed is presented in Table 3 (1/1 octave band frequency data provided with stated intended use limited for informational purposes only).

Table 3: GE 3.0-127 Wind Turbine Broadband Sound Power Level by Octave Band Frequency (12 m/s) with a Hub Height of 89 meters

Octave Band by Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
Band Sound Power Level (dBA)	92.6	98.0	100.6	104.2	105.5	102.1	94.1	76.0	110.0

Source: GE Renewable Energy 2018.

4.3 Substation Transformer Acoustic Modeling Input Parameters

The Project includes two 345 kV substations. Each substation would include two 285 megavolt ampere (MVA) transformers. The transformers at the proposed substations were included in the CadnaA noise model. Transformer sound power levels were provided based on a 285 MVA transformer. Table 4 presents the representative transformer sound power data by octave band center frequency calculated based on the National Electrical Manufacturers Association’s estimated transformer sound ratings and MVA using standardized engineering guidelines.

Table 4: 285 MVA Transformer Sound Power Level (L_w) by Octave Band Center Frequency

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
Sound Power Level (dB)	108	110	105	105	99	94	89	82	105

5 EXISTING ENVIRONMENT

5.1 Existing Ambient Noise

The Project is located in the southern portion of Albany County. The acoustical assessment evaluates NSAs within a 2-mile radius, which incorporates 148 NSAs (Figure 1). Ambient acoustic environment refers to the all-encompassing sound in a given environment or community. Albany County is generally considered a rural agricultural area. Existing ambient sound levels are expected to be relatively low, although sound levels would be higher near roadways such as U.S. Highway 287 as well as near the Union Pacific railroad. The existing WAPA transmission lines are also in the vicinity of the Project and would generate corona noise. Other human activity such as farming and ranching operations would seasonally contribute to sound levels in the area associated with farm animals and equipment. Background sound levels are expected to vary both spatially and temporally depending on natural sounds and proximity to area sound sources such as roadways. Typically, background sound levels are quieter during the night than during the daytime, except during periods when evening and nighttime insect noise may contribute to the soundscape, predominantly in the warmer seasons.

The western portion of the Project Area is comprised of lands previously analyzed for the former Hermosa West Wind Energy Project. An ambient sound survey for the Hermosa West Wind Energy Project was conducted in November 2010 and June 2011. The study presented L_{eq} noise levels based on a 24-hour period. The noise levels in the study showed that the existing ambient noise levels ranged from 45 dBA L_{eq} to 53 dBA L_{eq} (WAPA 2012).

6 ACOUSTICAL ASSESSMENT RESULTS

6.1 Construction Noise Results

The development of the Project will require construction activity to establish access roads, excavate and form WTG foundations, prepare the site for crane-lifting, and assemble and commission the wind turbines.

Work on these construction activities is expected to overlap. It is likely that the WTGs will be erected in small groupings. Each grouping may undergo periodic testing and commissioning prior to commencement of full commercial operation. Other construction activities include those for the supporting infrastructure such as the substation, maintenance building, and the overhead transmission line.

The construction of the Project may cause short-term but unavoidable noise impacts. The sound levels resulting from construction activities vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. The list and quantity of construction equipment that may be used per phase on the Project as well as estimates of near and far sound source levels per phase are presented in Table 5.

Table 5: Estimated Maximum Sound Pressure Levels from Construction Equipment for Each Phase

Phase of Construction	Equipment Type	Anticipated Amount of Equipment	Single Piece of Equipment		Anticipated Amount of Equipment[3]		Total Equipment for Phase[3]	
			L_{max}[1] at 50 ft (dBA)[2]	L_{max}[1] at 2000 ft (dBA)	L_{max}[1] at 50 ft (dBA)	L_{max}[1] at 2000 ft (dBA)	L_{max}[1] at 50 ft (dBA)	L_{max}[1] at 2000 ft (dBA)
Road Construction	Bulldozer	4	85	53	91	59	98	66
	Hoe and Ram Hoe	2	85	53	88	56		
	Haul Truck	15	84	52	96	64		
	Grader	2	85	53	88	56		
	Compactor	3	80	48	85	53		
Foundation Excavation	Hoe and Ram Hoe	4	85	53	91	59	94	62
	Air Drill	2	85	53	88	56		
	Bulldozer	2	85	53	88	56		
	Compactor	2	80	48	83	51		
Rebar	Picker	3	85	53	90	58	92	60
	Telehandler	2	85	53	88	56		
Concrete Placement	Belt Truck	2	85	53	88	56	98	66
	Telehandler	2	85	53	88	56		
	Concrete Truck	18	85	53	98	66		
Foundation Backfill	Bulldozer	4	85	53	91	59	92	60
	Compactor	2	80	48	83	51		
Wind Turbine Unloading	Crane	1	85	53	85	53	93	61
	Picker	2	85	53	88	56		
	Telehandler	3	85	53	89	58		
Wind Turbine Base Installation	Crane	2	85	53	88	56	95	63
	Picker	2	85	53	88	56		
	Telehandler	6	85	53	93	61		
Wind Turbine Tower Installation	Crane	2	85	53	88	56	95	63
	Picker	2	85	53	88	56		
	Telehandler	6	85	53	93	61		
Wind Turbine Nacelle/Rotor Installation	Crane	2	85	53	88	56	97	65
	Picker	2	85	53	88	56		
	Telehandler	6	85	53	93	61		
	Dozer	2	85	53	88	56		
	Haul Trucks	6	84	52	92	60		
	Manlift	2	80	48	83	51		

Table 5: Estimated Maximum Sound Pressure Levels from Construction Equipment for Each Phase

Phase of Construction	Equipment Type	Anticipated Amount of Equipment	Single Piece of Equipment		Anticipated Amount of Equipment[3]		Total Equipment for Phase[3]	
			L_{max}[1] at 50 ft (dBA)[2]	L_{max}[1] at 2000 ft (dBA)	L_{max}[1] at 50 ft (dBA)	L_{max}[1] at 2000 ft (dBA)	L_{max}[1] at 50 ft (dBA)	L_{max}[1] at 2000 ft (dBA)
Collection System	Trencher	2	84	52	87	55	95	63
	Bulldozer	2	85	53	88	56		
	Hoe	4	85	53	91	59		
	Haul Truck	2	84	52	87	55		
	Cable Truck/Trailer	2	80	48	83	51		
Substation	Drill Truck	1	85	53	85	53	93	61
	Bulldozer	1	85	53	85	53		
	Picker	1	85	53	85	53		
	Hoe	2	85	53	88	56		
	Bucket Truck	2	80	48	83	51		
	Pole Truck	1	80	48	80	48		
Miscellaneous	Picker	2	85	53	88	56	94	62
	Telehandler	4	85	53	91	59		
	Water Trucks	4	80	48	86	54		
	Grader	1	85	53	85	53		
	Fuel/Lube Truck	1	80	48	80	48		

[1]Maximum instantaneous sound level
[2]FHWA 2006; Bolt et al. 1977.
[3]Calculations assume all equipment operating simultaneously in close proximity to each other, which is very unlikely to occur.

6.2 Non-Blasting Construction Vibration Levels.

Each Project construction phase will incorporate mechanical equipment that will generate vibration levels. The significant vibration producing source will be earth moving equipment such as bull dozers. Pile driving is not expected occur. Blasting may occur but is discussed in Section 6.3.

Vibration levels for activities associated with the Project construction are based on average of source levels in PPV published within the FTA Noise and Vibration Manual (FTA 2006), which documents several types of heavy equipment measured under a wide variety of activities. Using the documented vibration levels as input into a basic propagation model, non-blasting project vibration levels were calculated at various distances from the source.

Project construction vibration levels are evaluated based on the worst-case vibration source, which will be bull dozers. Based on vibration propagation calculations, the vibration levels from the earth moving operations will be 0.089 Peak-Particle-Velocity (PPV) in/sec (87 vibration decibel (VdB)) at 25 feet from the source and will be 0.001 PPV in/sec (48 VdB) at 500 feet from the source. The vibration levels past 500 feet would not be distinguishable from ambient vibration levels. Based vibration criteria established the U.S. Department of the Interior, Bureau of Mines and the FTA safe level of vibrations for residential type structures is 0.5 PPV in/sec. Annoyance to humans is typically occurs at vibration levels above 80 VdB. Table 6 provides the vibration levels in 25-foot increments from the source. Based on the calculated vibration levels damage to structures could occur within 25 feet from the source and human annoyance could occur within 50 feet from the source. There are no sensitive receptors that will be located 50 feet or less from the earth moving equipment.

Table 6: Calculated Non-Blasting Vibration Levels from Construction

Distance from Source (ft)	Calculated Non-Blasting Vibration Levels	
	PPV in/sec	VdB
25	0.0890	87
50	0.0315	78
75	0.0171	73
100	0.0111	69
125	0.0080	66
150	0.0061	64
175	0.0048	62
200	0.0039	60
225	0.0033	58
250	0.0028	57
275	0.0024	56
300	0.0021	55
325	0.0019	54
350	0.0017	53
375	0.0015	52
400	0.0014	51
425	0.0013	50
450	0.0012	49
475	0.0011	49
500	0.0010	48

6.3 Blasting Noise

WTG tower foundations will normally be installed using typical construction methods as described above; however, if hard rock is encountered within the planned foundation area, blasting may be required to loosen or fracture the rock in order to reach the required depth to install the structure foundations. Locations where blasting may be required will be identified during the geotechnical engineering study.

Blasting is a short duration event as compared to rock removal methods such as using track rig drills, rock breakers, jack hammers, rotary percussion drills, core barrels, and/or rotary rock drills. Blasting creates a sudden and intense airborne noise potential as well as local ground vibration. Modern blasting techniques include electronically controlled ignition of multiple small explosive charges in an area of rock. The detonations are timed so that the energy from individual detonations destructively interferes with each other, which is called wave canceling. The total duration of a typical blast event is approximately 3/10 of a second. Impulse (instantaneous) noise from blasts could reach up to 140 dBA at the blast location, attenuating to approximately 90 dBA at a distance of 500 feet from the blast.

Blasting will be limited to between sunrise and sunset, if blasting is necessary during construction. Blasting plans will be required of all contracted blasting specialists, demonstrating compliance with all state and local blasting regulations, including the use of properly licensed personnel and obtaining all necessary permits and authorizations.

6.4 Operational Noise Results

Acoustic modeling was completed for WTG operation during maximum rotation using a conservative layout scenario of 151 turbine locations and the GE 3.0-127 WTG model. A sound contour plot displaying Project operational sound levels in color-coded isopleths is provided in Figure 2. The sound contours are graphical representations of the cumulative noise associated with the Project WTGs operating concurrently at the given operating condition and show how operational noise would be distributed over the surrounding area. The contour lines presented are analogous to elevation contours on a topographic map, i.e., the sound contours are continuous lines of equal noise level. Figure 2 displays broadband operational sound levels at wind speeds sufficient to sustain wind turbine operation at maximum rotational speeds during moderate downwind propagation. The resultant sound contour plot is independent of the existing acoustic environment, i.e., the plot and tabulated results represent Project-generated sound levels only.

Table 6 summarizes the predicted sound level impacts statistics across all 184 NSAs identified as occupied or potential residences as well as historical sites and a business. Appendix A presents the results of the Project acoustic modeling analysis and includes the NSA identification number, participation status, Universal Transverse Mercator (UTM) coordinates, and the modeled received dBA sound levels at each NSA. Received sound levels are rounded to the nearest whole decimal.

Table 7: Acoustic Modeling Results Summary

Received Sound Level Ranges (dBA)	Number of Modeled NSAs
Total	**184**
<30	36
30 to 35	76
35 to 40	36
40 to 45	32
45 to 50	3
50 to 55	1
> 55	0

As outlined in Table 7 and illustrated in Figure 2, none of the NSAs (184) within the 2-mile analysis area would experience operational Project noise greater than the expected existing ambient noise range within the Project Area as documented in the Hermosa West Wind Energy Project ambient sound survey (45-53 dBA; WAPA 2012). The single NSA location within the 50-55 dBA range include a participating landowner (modeled at 50 dBA), which also falls within the existing 45-53 dBA ambient noise level.

As stated above, Albany County Wind Energy Siting Regulations limit noise from commercial wind energy facilities to 55 dBA as measured at a point along the common property lines between a non-participating private property and a participating property (Albany County 2017). While no NSAs fall within areas that would be expected to experience levels above 55 dBA, there are some locations, primarily along the northern and northwestern portions of the Project Area, where modeling of the representative turbine layout shows a small overlap of sound levels slightly above 55 dBA at common property lines between non-participating private property and a participating property (Figure 2). Should this turbine layout ultimately be chosen for the Project, and if written landowner permission cannot be obtained in these locations, micrositing of turbines may be necessary in order to avoid exceeding the 55 dBA county threshold requirements in these locations.

6.5 Corona Noise

Operational noise may also be produced by the proposed 345-kV transmission line associated with the Project. Transmission line noise is typically referred to as corona noise.

Corona noise is caused by the partial electrical breakdown of the insulating properties of air around the electrical conductors and overhead power lines. Audible noise generated by corona on transmission lines has two major components. The higher frequencies of the broadband component distinguish it from more common outdoor environmental noise. The random phase relationship of the pressure waves generated by each corona source along a transmission line results in a characteristic sound commonly described as crackling, frying, or hissing. The second component is a lower-frequency sound that is superimposed over the broadband noise. The corona discharges produce positive and negative ions that, under the influence of the alternating electric field around alternating current (AC) conductors, are alternately attracted to and repelled from the conductors. This motion establishes a sound-pressure wave having a frequency twice that of the voltage; i.e., 120 hertz (Hz) for a 60 Hz system. Higher harmonics (e.g., 240 Hz) may also be present, but they are generally of lower significance (EPRI 2005). Corona activity increases with increasing altitude, and with increasing voltage in the line, but is generally not affected by system loading. The relative magnitude of hum and broadband noise may be different depending on weather conditions at the line. According to the Electric Power Research Institute (EPRI), when the line is wet (such as during rainy weather conditions), the broadband component typically dominates; however, under icing conditions the lower frequency components may be more prevalent.

Corona noise levels during precipitation may vary over a wide range. During the initial stages, when the conductors are not thoroughly wet, there may be considerable fluctuation in the noise level as the precipitation intensity varies. When the conductors are thoroughly wet, the noise fluctuations will often be less significant, since even as the intensity of precipitation diminishes the conductors will still be saturated, which can result in corona discharge. The variation in noise levels during rain depends greatly on the condition of the conductor surface and on the voltage gradient at which the conductors are operating. At high operating gradients, the audible noise is less sensitive to rain rate than at low gradients. Consequently, the variation in noise levels is less for the higher gradients. In different weather conditions the relative magnitudes of random noise and hum may be different. Noise levels in fog and snow usually do not attain the same magnitude as compared to rain, and elevated noise levels during fog and snow are usually for a shorter duration in proportion to the event (EPRI 1982).

During fair weather conditions, corona occurs only at scratches or other imperfections in the conductor surface or where dust has settled on the line. These limited sources are such that the corona activity is minimal, and the audible noise generated is very low. Generally, the fair-weather audible noise of transmission lines cannot be distinguished from ambient noise at the edge of the right-of-way.

Corona noise is not generally an issue at substations. The presence of equipment such as circuit breakers, switches, and measuring devices reduces the electromagnetic field gradient on the buses to a great extent. In addition, the distance from most of the buses to the perimeter of the substation is considerable (on the average, greater than 100 m). Consequently, low levels of corona noise would likely not be readily detectable immediately outside the substation fence line (EPRI 1982).

7 POTENTIAL EFFECTS ANALYSIS

Sounds generated by construction activities are typically exempt from state and local noise oversight if they occur within weekday, daytime periods as may be specified under local zoning or legal codes. The nearest NSA is located 1,880 feet from WTG locations. Based on Table 5 construction noise levels at this distance is expected to range from 60 dBA to 66 dBA per overall construction phase. All reasonable efforts will be made to minimize the impact of noise resulting from construction activities. As the design of the Project progresses and construction scheduling is finalized, the construction engineer normally notifies the community, via public notice or alternative method, of the expected Project construction commencement and duration to help minimize the effects of construction noise. In addition, stationary equipment and construction laydown areas will be sited to avoid existing NSAs to the extent practicable.

Project operational sound was calculated for a representative turbine layout that includes the greatest number of WTGs (i.e. 151) and using the WTG model with the highest potential sound emission levels. The calculation also included both associated substations. Acoustic modeling analyses per ISO 9613-2 was also inclusive of a number of conservative assumptions as outlined above. Based on the results of the analysis, it is expected that received sound levels at NSAs potentially impacted by the Project will fall within existing ambient noise levels (WAPA 2012) and will be compliant with the 55 dBA limit prescribed in the Albany County Wind Energy Siting Regulations (Albany County 2017) where residential NSAs are located.

As discussed in Section 6.3, Figure 2 indicates that there are some locations, primarily along the northern and northwestern portions of the Project Area, where modeling of the representative turbine layout shows a small overlap of sound levels slightly above 55 dBA at common property lines between non-participating private property and a participating property. If written landowner permission cannot be obtained in these locations, micrositing of turbines may be necessary in order to avoid exceeding the 55 dBA county threshold requirements in these locations.

7.1 Applicant-Proposed Environmental Protection Measures

ConnectGen has developed EPMs that when implemented would avoid or minimize adverse effects to environmental resources from construction, operations and maintenance, and decommissioning of the Project. The EPMs listed in Table 8 below would both directly and indirectly avoid or reduce potential noise effects from development of the Project.

Table 8: Proposed Environmental Protection Measures Related to Noise Resources for the Rail Tie Wind Project

Resource Category	Measure	Implementation			
		Preconstruction	Construction	Operations	Decommissioning
General					
GEN-1	The Project will be designed, constructed, and operated in compliance with Albany County Zoning Regulations (as amended) and Albany County Wind Energy Siting Regulations. Construction and operations activities will comply with all federal, state, and county environmental regulations, as applicable.	X	X	X	X
GEN-2	The Project will delineate environmentally sensitive areas (e.g. wetlands, waters, habitats) located within or adjacent to the Project Area and will identify those locations in construction planning documents. Construction and operations personnel will be informed of the appropriate practices that may be applicable to avoid or minimize impacts to these areas.	X	X	X	X
GEN-3	Construction travel will be restricted to existing roads and permanent or temporary access roads identified in the final Project Site Plan.		X		
GEN-4	The Project will implement speed limits on construction and permanent access roads to minimize potential for fugitive dust, impacts to wildlife, and for safety purposes. Speed limit signs will be posted as appropriate.		X	X	X
GEN-5	Construction and operations equipment will be inspected periodically per the manufacturer's specifications and maintained in good working condition.		X	X	X
GEN-7	Routine operation and maintenance activities will be scheduled and performed during daylight hours.			X	
Air Quality					
AQ-5	Idling equipment will be turned off when not in use.		X	X	X
Public Health and Safety					
PHS-5	An Environmental Health and Safety Plan (EHS Plan) will be prepared for worker protection, as required by OSHA, with emphasis on safety and health regulations for construction and operations and maintenance. All employees would be required to conform to safety procedures and to receive appropriate training for their job responsibilities. The EHS Plan will include requirements for first aid and other emergency medical material to be stored on site and in maintenance vehicles.		X	X	

Resource Category	Measure	Implementation			
		Preconstruction	Construction	Operations	Decommissioning
PHS-6	Construction equipment will be outfitted with OSHA-required safety devices. Hard hats, safety boots, ear and eye protective equipment, and other safety equipment will be used on the construction site.		X		
Noise					
NOISE-1	Construction vehicles and equipment will be maintained in proper operating condition and will be equipped with manufacturers' standard noise control devices or better (e.g., mufflers, engine enclosures).		X		X
NOISE-2	Construction and hauling equipment will be maintained adequately and equipped with appropriate mufflers.		X		X
NOISE-3	Blasting or hydraulic hammering will be limited to daylight hours.		X		X

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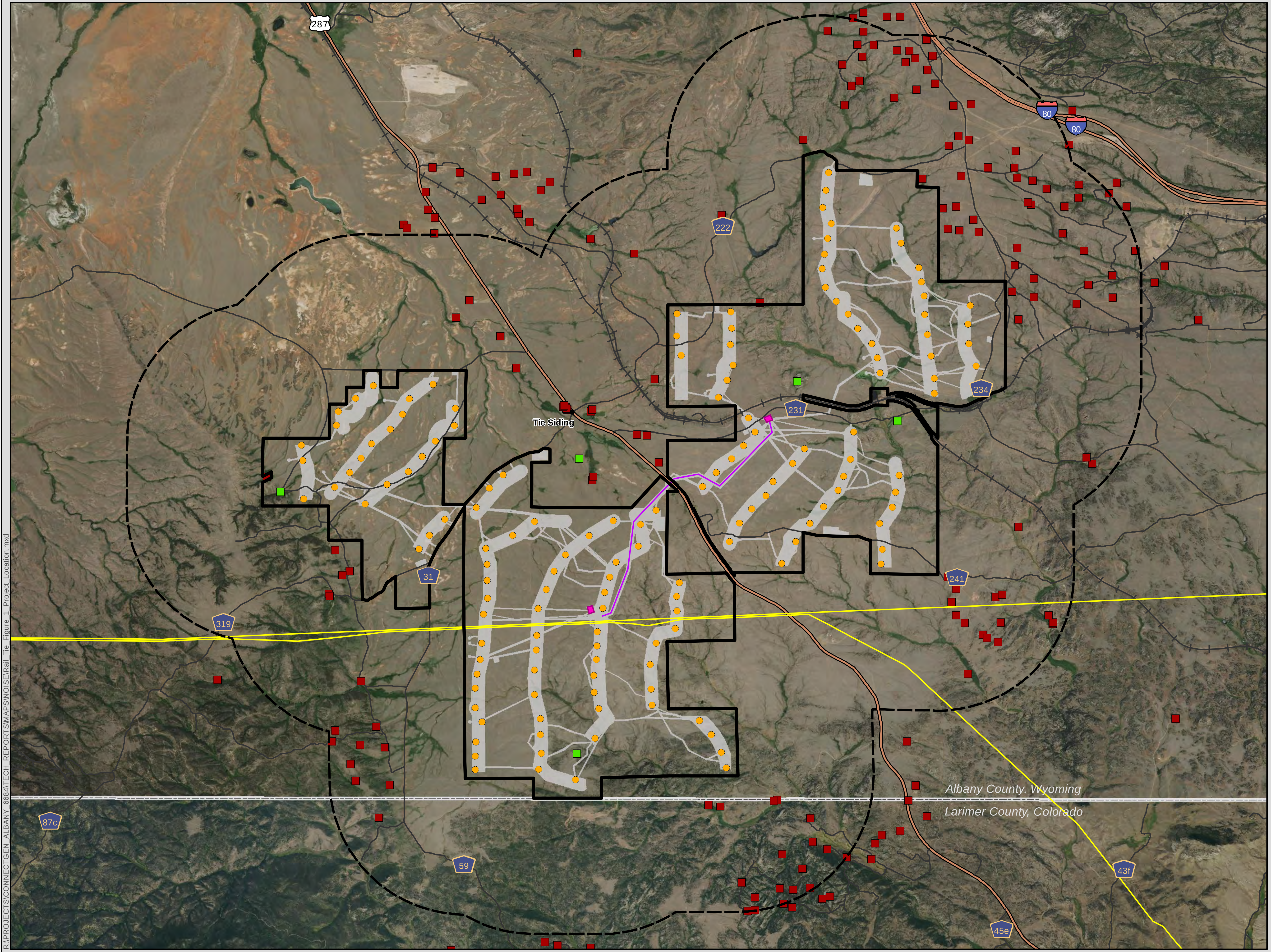
FIGURES



ConnectGEN

Rail Tie Wind Project

Figure 1
Project Location

Albany County, WY

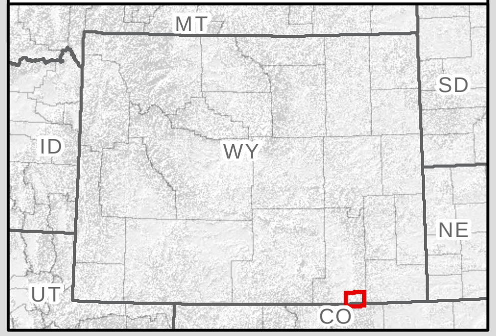
Project Area
Analysis Area
Representative Project Layout
Turbine
Project Substation
Transmission Line
1,000' Turbine Siting Corridor
Noise Sensitive Receptor
Participating Receptor
Non-Participating Receptor
State/County Boundary
Highways
County Roads
Union Pacific Railroad
Existing Transmission Line

NOTE: WTG locations shown in the figure are representative and may change based on final engineering, environmental review and WTG model selection.

N

0 0.5 1 2
Miles

NOT FOR CONSTRUCTION



TETRA TECH

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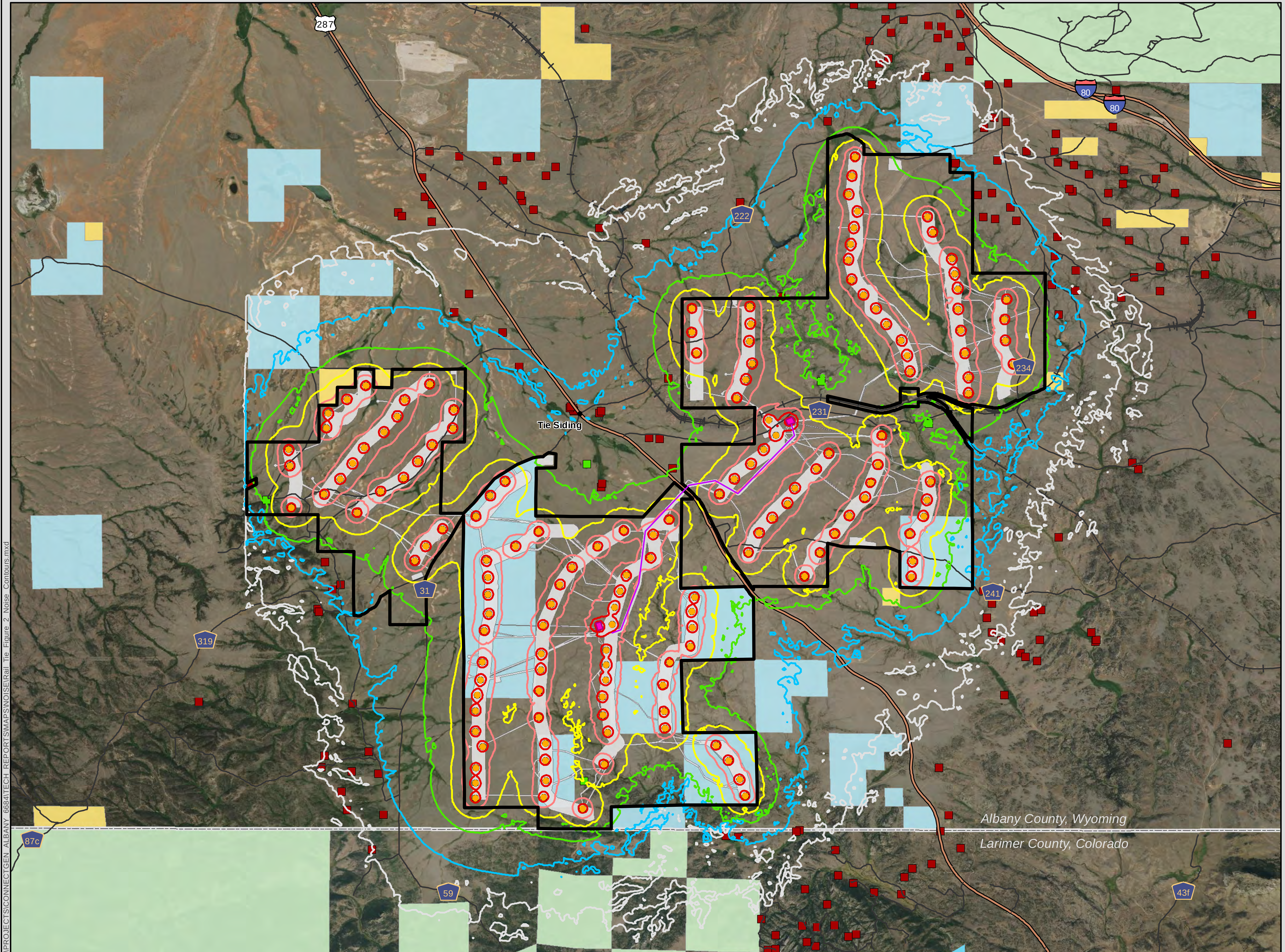

ConnectGEN

Rail Tie Wind Project

Figure 2
Modeled Received Sound Levels

Albany County, WY

Project Area

Representative Project Layout

Turbine

Project Substation

Transmission Line

1,000' Turbine Siting Corridor

Noise Sensitive Receptor

Participating Receptor

Non-Participating Receptor

State/County Boundary

Highways

County Roads

Union Pacific Railroad

Land Ownership

BLM

USFS

State Land

Private

Sound Level Contours (dBA):

35

40

45

50

55

> 60

NOTE: WTG locations shown in the figure are representative and may change based on final engineering, environmental review and WTG model selection.

N

0 0.5 1 2

Miles

NOT FOR CONSTRUCTION

TETRA TECH

APPENDIX A:
Detailed Summary of Acoustical Assessment Results

Table A-1: Summary of Acoustic Modeling Results for the Rail Tie Wind Project

Noise Sensitive Area ID	Participant Status	UTM Coordinates (m)		Received Sound Levels (GE 3.0-127 WTG Model) (dBA)
		Easting (X)	Northing (Y)	
1	Non-Participating Residence	457841	4546174	44
2	Non-Participating Residence	466463	4542963	36
3	Non-Participating Residence	466462	4543599	38
4	Non-Participating Residence	466664	4542785	34
5	Non-Participating Residence	467391	4543403	32
6	Non-Participating Residence	467095	4542498	33
7	Non-Participating Residence	467200	4542426	32
8	Non-Participating Residence	457799	4547805	41
9	Non-Participating Residence	457835	4547843	41
10	Non-Participating Residence	459130	4547236	43
11	Non-Participating Residence	457237	4547848	41
12	Non-Participating Residence	468306	4550509	37
13	Non-Participating Residence	468308	4550957	38
14	Non-Participating Residence	467855	4551273	41
15	Non-Participating Residence	466999	4552056	41
16	Non-Participating Residence	466532	4552098	43
17	Non-Participating Residence	466464	4552660	41
18	Non-Participating Residence	466143	4552618	43
19	Participating Residence	457465	4539680	**50**
20	Non-Participating Residence	462220	4538588	38
21	Non-Participating Residence	462146	4538559	38
22	Non-Participating Residence	465504	4538929	31
23	Non-Participating Residence	465296	4539973	30
24	Participating Residence	465073	4547576	45
25	Non-Participating Residence	456028	4548833	41
26	Non-Participating Residence	458826	4551551	38
27	Non-Participating Residence	463812	4555064	38
28	Non-Participating Residence	463978	4555525	36
29	Non-Participating Residence	465268	4556082	34
30	Non-Participating Residence	465350	4556351	32
31	Non-Participating Residence	465058	4556367	33
32	Non-Participating Residence	465522	4555438	32
33	Non-Participating Residence	464996	4555238	35
34	Non-Participating Residence	465493	4556178	33
35	Non-Participating Residence	466395	4555058	35
36	Non-Participating Residence	452082	4544016	42
37	Non-Participating Residence	451740	4544514	43
38	Non-Participating Residence	450120	4546248	45
39	Participating Residence	450446	4545890	48
40	Non-Participating Residence	454925	4550442	38
41	Non-Participating Residence	467518	4542799	33
42	Non-Participating Residence	466741	4541579	32
43	Non-Participating Residence	468750	4542757	28

Table A-1: Summary of Acoustic Modeling Results for the Rail Tie Wind Project

Noise Sensitive Area ID	Participant Status	UTM Coordinates (m)		Received Sound Levels (GE 3.0-127 WTG Model) (dBA)
		Easting (X)	Northing (Y)	
44	Non-Participating Residence	467937	4545064	34
45	Non-Participating Residence	467789	4550643	43
46	Non-Participating Residence	467903	4551694	38
47	Non-Participating Residence	469605	4550804	32
48	Non-Participating Residence	470167	4551033	30
49	Non-Participating Residence	469493	4551611	31
50	Non-Participating Residence	470715	4551615	30
51	Non-Participating Residence	466869	4552348	41
52	Non-Participating Residence	466270	4552132	44
53	Non-Participating Residence	465665	4553321	41
54	Non-Participating Residence	466290	4554106	37
55	Non-Participating Residence	466767	4554238	36
56	Non-Participating Residence	466814	4555090	34
57	Non-Participating Residence	467841	4553573	34
58	Non-Participating Residence	467911	4553343	32
59	Non-Participating Residence	468245	4552702	34
60	Non-Participating Residence	465962	4555575	34
61	Non-Participating Residence	465779	4555900	34
62	Non-Participating Residence	463763	4556026	32
63	Non-Participating Residence	464233	4556210	34
64	Non-Participating Residence	464114	4556507	33
65	Non-Participating Residence	464508	4556494	33
66	Non-Participating Residence	469033	4552662	31
67	Non-Participating Residence	469360	4552867	30
68	Non-Participating Residence	452109	4539441	37
69	Non-Participating Residence	453033	4538940	39
70	Non-Participating Residence	452227	4539035	36
71	Non-Participating Residence	452919	4539839	40
72	Non-Participating Residence	452333	4539888	38
73	Non-Participating Residence	452704	4540327	39
74	Non-Participating Residence	451661	4539979	36
75	Non-Participating Residence	451735	4540239	37
76	Non-Participating Residence	452351	4541399	39
77	Non-Participating Residence	465327	4538575	30
78	Non-Participating Residence	465767	4538199	27
79	Non-Participating Residence	465132	4537846	31
80	Non-Participating Residence	466354	4543280	38
81	Non-Participating Residence	470173	4550498	32
82	Non-Participating Residence	470092	4552977	28
83	Non-Participating Residence	470509	4552658	27
84	Non-Participating Residence	470267	4553224	27
85	Non-Participating Residence	469375	4553184	31
86	Non-Participating Residence	467873	4553975	34

Table A-1: Summary of Acoustic Modeling Results for the Rail Tie Wind Project

Noise Sensitive Area ID	Participant Status	UTM Coordinates (m)		Received Sound Levels (GE 3.0-127 WTG Model) (dBA)
		Easting (X)	Northing (Y)	
87	Non-Participating Residence	460593	4538470	40
88	Non-Participating Residence	460867	4538436	41
89	Non-Participating Residence	452777	4538168	36
90	Non-Participating Residence	464703	4537750	29
91	Non-Participating Residence	463004	4538157	32
92	Non-Participating Residence	457003	4535142	29
93	Non-Participating Residence	457789	4535076	30
94	Non-Participating Residence	469693	4546563	33
95	Non-Participating Residence	472200	4549976	27
96	Non-Participating Residence	456285	4553477	32
97	Non-Participating Residence	456827	4553245	33
98	Non-Participating Residence	456619	4553046	33
99	Non-Participating Residence	456343	4552296	34
100	Non-Participating Residence	456090	4552492	32
101	Non-Participating Residence	456055	4552609	32
102	Non-Participating Residence	455669	4552943	31
103	Non-Participating Residence	455544	4553378	30
104	Non-Participating Residence	454693	4553473	31
105	Non-Participating Residence	454045	4553587	32
106	Non-Participating Residence	453889	4553010	33
107	Non-Participating Residence	453943	4552583	34
108	Non-Participating Residence	453355	4552233	34
109	Non-Participating Residence	454094	4552029	35
110	Non-Participating Residence	465897	4556232	29
111	Participating Residence	457520	4546681	43
112	Non-Participating Residence	454595	4550029	40
113	Participating Residence	462697	4548511	45
114	Business	457213	4547905	41
115	Non-Participating Residence	457224	4547865	41
116	Non-Participating Residence	469211	4554941	26
117	Non-Participating Residence	459409	4546590	45
118	Non-Participating Residence	462833	4554243	42
119	Non-Participating Residence	459316	4548567	46
120	Non-Participating Residence	466268	4543875	39
121	Non-Participating Residence	471664	4540515	19
122	Non-Participating Residence	468766	4542796	28
123	Non-Participating Residence	468656	4542963	29
124	Non-Participating Residence	467456	4542328	34
125	Non-Participating Residence	469563	4546710	34
126	Non-Participating Residence	467552	4543458	33
127	Non-Participating Residence	467936	4549979	43
128	Non-Participating Residence	469318	4550356	37
129	Non-Participating Residence	468990	4552024	33

Table A-1: Summary of Acoustic Modeling Results for the Rail Tie Wind Project

Noise Sensitive Area ID	Participant Status	UTM Coordinates (m)		Received Sound Levels (GE 3.0-127 WTG Model) (dBA)
		Easting (X)	Northing (Y)	
130	Non-Participating Residence	468605	4553079	31
131	Non-Participating Residence	468168	4552754	35
132	Non-Participating Residence	468271	4553277	31
133	Non-Participating Residence	467220	4553589	36
134	Non-Participating Residence	469134	4554130	28
135	Non-Participating Residence	466517	4554329	35
136	Non-Participating Residence	464174	4555637	35
137	Fire Station	465759	4556623	31
138	Non-Participating Residence	464263	4556820	23
139	Non-Participating Residence	463413	4556830	24
140	Non-Participating Residence	464024	4557132	24
141	Non-Participating Residence	464261	4557256	24
142	Non-Participating Residence	463173	4559266	19
143	Non-Participating Residence	457483	4556301	24
144	Non-Participating Residence	460902	4552456	39
145	Non-Participating Residence	457795	4551891	34
146	Non-Participating Residence	458894	4547254	43
147	Non-Participating Residence	453441	4552153	34
148	Non-Participating Residence	455659	4549583	40
149	Non-Participating Residence	457151	4547916	41
150	Non-Participating Residence	457171	4547945	41
151	Non-Participating Residence	451906	4543912	41
152	Non-Participating Residence	448953	4541437	20
153	Non-Participating Residence	451581	4543473	36
154	Non-Participating Residence	451606	4543418	37
155	Non-Participating Residence	457857	4546255	44
156	Non-Participating Residence	454099	4552407	34
157	Non-Participating Residence	461517	4535950	33
158	Non-Participating Residence	461685	4535966	33
159	Non-Participating Residence	461689	4536278	34
160	Non-Participating Residence	461374	4536629	32
161	Non-Participating Residence	462375	4536118	29
162	Non-Participating Residence	462570	4536035	31
163	Non-Participating Residence	462992	4536499	32
164	Non-Participating Residence	462602	4536458	32
165	Non-Participating Residence	462282	4536488	29
166	Non-Participating Residence	464536	4537554	32
167	Non-Participating Residence	464457	4537182	30
168	Non-Participating Residence	463866	4537223	29
169	Non-Participating Residence	463289	4536244	30
170	Non-Participating Residence	462341	4537295	33
171	Non-Participating Residence	462826	4536959	30
172	Non-Participating Residence	463065	4537590	31

Table A-1: Summary of Acoustic Modeling Results for the Rail Tie Wind Project

Noise Sensitive Area ID	Participant Status	UTM Coordinates (m)		Received Sound Levels (GE 3.0-127 WTG Model) (dBA)
		Easting (X)	Northing (Y)	
173	Non-Participating Residence	463406	4537419	33
174	Non-Participating Residence	454494	4535026	28
175	Non-Participating Residence	463468	4536295	27
176	Non-Participating Residence	456714	4535212	29
177	Non-Participating Residence	455214	4552824	33
178	Non-Participating Residence	455978	4553440	32
179	Non-Participating Residence	471171	4550859	27
180	Non-Participating Residence	471403	4551252	28
181	Non-Participating Residence	464819	4557157	22
182	Non-Participating Residence	465137	4557163	19
183	Historical Site	466582	4553384	39
184	Historical Site	461813	4550378	44